

Linzer biol. Beitr.	43/2	1247-1252	19.12.2011
---------------------	------	-----------	------------

A comment on Iranian fig wasps (Chalcidoidea: Agaonidae, Pteromalidae)

H. GHAHARI & S. VAN NOORT

Abstract: A total of 5 species of fig wasps from 5 genera including, *Blastophaga*, *Elisabethiella* (Agaonidae), and *Apocrypta*, *Sycophaga*, *Apocryptophagus* (Pteromalidae) are recorded from Iran. Among the collected fig wasps, *Apocryptophagus gigas* (MAYR) is a new record for the Iranian fauna.

Key words: Fig wasp, Agaonidae, Pteromalidae, *Ficus*, Iran.

Introduction

Fig wasps include the pollinating fig wasps (Chalcidoidea: Agaonidae) and a diverse assemblage of non-pollinating fig wasps (Chalcidoidea: Pteromalidae, Eurytomidae, Ormyridae) that are also associated with individual fig tree species (VAN NOORT & VAN HARTEN 2006). The relationship between pollinating fig wasps (Chalcidoidea, Agaonidae) and their host fig trees (*Ficus* L. 1753, Moraceae) is a classic example of an obligate mutualism, where neither partner can reproduce without the other, the wasp providing a pollination service and the fig tree in turn providing a breeding site for the pollinating wasp's progeny (JANZEN 1979). The obligate mutualism between pollinating fig wasps and their host fig trees (*Ficus*, Moraceae) has historically been considered to be a one-to-one relationship (RAMIREZ 1970; WIEBES 1979; WIEBES & COMPTON 1990; VAN NOORT 2004), but increasing evidence is suggesting that the relationship is not as tight as has previously been supposed, with records of more than one species of pollinator associated with a single host and, conversely, of a single pollinator species associated with more than one host fig species (COMPTON & VAN NOORT 1992; WEST & HERRE 1994; WEST et al. 1996; MICHALOUD et al. 1996; KERDELHUÉ & RASPLUS 1996a, 1996b; COOK & RASPLUS 2003; MOLBO et al. 2003; ZHANG et al. 2004).

Local Iranian *Ficus* species richness is fairly high for an arid region. In total 10 species and varieties have been recorded from Iran: *Ficus bengalensis* L., *F. carica* L. var. *genuine* BOISS., *F. carica* L. var. *johannis* BOISS., *F. carica* L. var. *rupestris* HAUSSKN., *F. elastica* ROXBG., *F. elastica* ROXBG. var. *aurea*, *F. eriobotryoides* KUNTH & BOUCHE, *F. persica* BOISS., *F. pumila* L. and *F. religiosa* L. (SABETI 1994). Nine species were recorded from Yemen (VAN NOORT & VAN HARTEN 2006), and seven species were listed for UAE (VAN NOORT & RASPLUS 2010).

The fig wasp fauna of Iran was poorly studied so far (FAZELI 1987; MODARRES AWAL

1997; STOJANOVA & GHAHARI 2009). In this paper, we have collected all the data on Iranian fig wasps from two families Agaonidae and Pteromalidae.

Materials and Methods

The materials were collected by light traps and Malaise traps from different regions of Iran through 2004-2008. Classification, nomenclature and distributional data suggested by BOUCEK et al. (1981), BERG & WIEBES (1992), VAN NOORT (2004), VAN NOORT & VAN HARTEN (2006) and CRUAUD et al. (2010) have been followed.

Results

Totally 5 species of fig wasps from 5 genera and 2 families (Agaonidae and Pteromalidae) were collected from different regions of Iran.

Family A g a o n i d a e

Blastophaga psenes (LINNAEUS 1758)

Cynips psenes LINNAEUS 1758 – Systema naturae (10th Edition) 1: 554.

Blastophaga grossorum GRAVENHORST 1827 – Übersicht der Arbeit und Veränderungen der schlesischen Gesellschaft für vaterländische Kultur 1826: 23.

Blastophaga vaidi JOSEPH 1954 – Agra University Journal of Research (Science) 3: 401-408.

Blastophaga psenes. GRANDI 1929 – Bollettino del Laboratorio di Entomologia del R. Istituto Superiore Agrario di Bologna 2: 1-147. Grandi 1963; Bollettino dell'Istituto di Entomologia della Università degli Studi di Bologna 26: 325-326 (synonymy of *B. grossorum*). WIEBES 1993; Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C) 96: 351 (synonymy of *B. vaidi*).

Material examined: East Azarbayjan province: Arasbaran (976 m), 3 ♀ ♀, on *Ficus* sp., 24 June 2007; Mazandaran province: Behshahr (67 m), 2 ♀ ♀, on *Ficus* sp., 15 August 2007.

Distribution outside Iran: Afrotropical: Eritrea, Ethiopia, South Africa; Australasia: Australia; Palaearctic: Afghanistan, Algeria, Armenia, Canary Islands, Caucasus, France, India, Israel, Italy, Pakistan, Turkey, Ukraine.

Elisabethiella socotrensis (MAYR 1885)

Blastophaga socotrensis MAYR 1885 – Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien 35: 175-176.

Blastophaga dyscritus WATERSTON 1921 – Transactions of the Entomological Society of London 1921: 417-418.

Blastophaga socotrensis. GRANDI 1928a – Bollettino del Laboratorio di Entomologia del R. Istituto Superiore Agrario di Bologna 1: 69 (placed in subgenus *Elisabethiella*). GRANDI 1928b; Bollettino del Laboratorio di Entomologia del R. Istituto Superiore Agrario di Bologna 1: 159-163 (redescription; synonym *B. dyscritus* WATERSTON 1921).

Elisabethiella socotrensis. WIEBES 1977 – Netherlands Journal of Zoology **27**: 210 (host record by MAYR 1885 incorrect; may have been *F. vasta*). WIEBES 1989 a; Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C) **92**: 117-136 (confirmation of host record, review, key to species). BERG & WIEBES 1989; Koninklijke Nederlandse Akademie van Wetenschappen, Verhandelingen Afdeling Natuurkunde, Tweede Reeks, Deel 89, Amsterdam: 242 (review).

Material examined: Yazd province: Tabas (663 m), 2 ♀ ♀, on *Ficus* sp., 22 September 2006.

Distribution outside Iran: Afrotropical: Ethiopia, Saudi Arabia, Socotra (ex *F. vasta*); Kenya, Zambia (ex *F. wakefieldii*); South Africa, Zimbabwe (ex *F. natalensis*); Uganda, Yemen (host unknown).

Family Pteromalidae

Subfamily Sycoryctinae

***Apocrypta longitarsus* MAYR 1906**

Apocrypta longitarsus MAYR 1906 – Wiener Entomologische Zeitung **25**: 163-164.

Apocrypta minima RISBEC 1951 – Mémoires de l'Institut Français d'Afrique Noire **13**: 389-390.

Apocryptophagus bambeyi RISBEC 1951 – Mémoires de l'Institut Français d'Afrique Noire **13**: 318.

Apocrypta longitarsus MAYR 1906 – ULENBERG & van PELT 1985; Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afdeling Natuurkunde, Tweede Reeks **83**: 118-121 (synonymy of *A. minima* & *A. bambeyi*, redescription).

Material examined: Fars province: Kazeroon (842 m), 3 ♀ ♀, on *Ficus* sp., 18 March 2006.

Distribution outside Iran: Afrotropical: Botswana, Cameroon, Comoro Islands, Eritrea, Kenya, Madagascar, Malawi, Namibia, Senegal, South Africa, Tanzania, Yemen, Zambia and Zimbabwe; Palaearctic: Israel.

***Apocryptophagus gigas* (MAYR 1906)**

Eukoebelea gigas MAYR 1906 – Wiener Entomologische Zeitung **25**: 164-165.

Parakoebelea gigas (MAYR 1906) – WIEBES 1968; Zoologische Mededelingen **42**: 318 (combination).

Apocryptophagus gigas (MAYR 1906) – BERG & WIEBES 1992; Koninklijke Nederlandse Akademie van Wetenschappen, Verhandelingen Afdeling Natuurkunde, Tweede Reeks, Deel 89, Amsterdam: 176 (combination).

Material examined: Sistan & Baluchestan province: Mirjaveh (835 m), 1 ♀, on *Ficus* sp., 9 August 2005. **New record for Iran.**

Distribution outside Iran: Afrotropical: Botswana, Comoro Islands, Ethiopia, Kenya, Madagascar, Malawi, Namibia, Senegal, South Africa, Tanzania, Yemen, Zambia and Zimbabwe.

***Sycophaga sycomori* (LINNAEUS 1758)**

Cynips sycomori LINNAEUS 1758 – Systema naturae (10th Edition) **1**: 554.

Sycophaga crassipes WESTWOOD 1840 – Transactions of the Entomological Society of London II: 222-223.

Material examined: East Azarbayjan province: Arasbaran (867 m), 2 ♀ ♀, on *Ficus* sp., 5 June 2007.

Distribution outside Iran: Afrotropical: Botswana, Comoro Islands, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Namibia, Senegal, South Africa, Tanzania, Yemen, Zimbabwe, Zambia; Palaearctic: Egypt, Greece, Israel, Syria.

Discussion

Upon this research, the fauna of Iranian fig wasps is rather diverse, which it has been resulted from various species and subspecies of fig trees in Iran. The continuing of studies on fig wasps (fauna and biology) is necessary for determining of these beneficial insects. Iran is a large country with various geographical regions and climates and therefore we expect that many other species of fig wasps are remained to be found. On the other hand, fig wasps are a fantastic subject for evolutionary study, especially for investigations of coevolved mutualism between pollinators and their host plants (WIEBES 1979). Comparative approaches to the study of fig wasp evolution were limited until recently by the ambiguity of phylogeny estimates for the lineages involved. Molecular phylogenies provide new opportunities to examine evolutionary hypotheses drawn from the specificity of fig wasp interactions (RAMIREZ 1974; WEIBLEN 2002). Therefore collecting the specimens from different regions of Iran and especially from different species of fig trees and analyzing the specimens will be resulted to reveal of phylogenetic and evolutionary ambiguities.

Acknowledgments

The authors are indebted to Dr. J.-Y. Rasplus (Entomologiste INRA, France), Dr. K.J. Hedqvist (Höstvägen 1, SE-186 31 Vallentuna, Sweden) and Dr. G.D. Weiblen (University of Minnesota) for valuable helps in progress of the project. The research was supported by Islamic Azad University (Shahre Rey Branch) and Iziko Museums of Cape Town.

Zusammenfassung

5 Feigenwespenarten der Gattungen *Blastophaga*, *Elisabethiella* (Agaonidae) sowie *Apocrypta*, *Sycophaga*, *Apocryptophagus* (Pteromalidae) wurden aus dem Iran nachgewiesen, *Apocryptophagus gigas* (MAYR) stellte einen Erstnachweis für die iranische Fauna dar.

References

- BERG C.C. & J.T. WIEBES (1992): African fig trees and fig wasps. 298 pp. — Amsterdam; Koninklijke Nederlandse Akademie van Wetenschappen, Verhandelingen Afdeling Natuurkunde, Tweede Reeks, Deel 89.
- BOUCEK Z., WATSHAM A. & J.T. WIEBES (1981): The fig wasp fauna of the receptacles of *Ficus thonningii* (Hymenoptera, Chalcidoidea). — Tijdschrift voor Entomologie **124**: 149-233.
- COMPTON S.G. & S. VAN NOORT (1992): Southern African fig wasps (Hymenoptera: Chalcidoidea): resource utilization and host relationships. — Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C) **95**: 423-435.

- COOK J.M. & J.Y. RASPLUS (2003): Mutualists with attitude: coevolving fig wasps and figs. — *Trends in Ecology and Evolution* **18**: 241-248.
- CRUAUD A., JABBOUR-ZAHAB R., GENSON G., CRUAUD C., COULOUX A., KJELLBERG F., VAN NOORT S. & J.-Y. RASPLUS (2010): Laying the foundations for a new classification of Agaonidae (Hymenoptera: Chalcidoidea), a multilocus phylogenetic approach. — *Cladistics* **26**: 359-387.
- FAZELI M. (1987): Some preliminary research on *Blastophaga psenes* L. in Iran. — *Entomology and Phytopathology Appliqata* **54**: 75-82.
- JANZEN D.H. (1979): How to be a fig. — *Annual Review of Ecology and Systematics* **10**: 13-51.
- KERDELHUÉ C. & J.-Y. RASPLUS (1996a): Non-pollinating Afrotropical fig wasps affect the fig-pollinator mutualism in *Ficus* within the subgenus *Sycomorus*. — *Oikos* **75**: 3-14.
- KERDELHUÉ C. & J.Y. RASPLUS (1996b): The evolution of dioecy among *Ficus* (Moraceae): an alternative hypothesis involving nonpollinating fig wasp pressure on the fig-pollinator mutualism. — *Oikos* **77**: 163-166.
- MICHALOUD G., CARRIERE S. & M. KOBBI (1996): Exceptions to the one: one relationship between African fig trees and their fig wasp pollinators: possible evolutionary scenarios. *J. Biogeog.* **23**: 513-520.
- MODARRES AWAL M. (1997): Family Agaonidae (Hymenoptera), pp. 260. — In: MODARRES AWAL M. (ed.), *List of agricultural pests and their natural enemies in Iran*. Ferdowsi University Press, 429 pp.
- MOLBO D., MACHADO C.A., SEVENSTER J.G., KELLER L. & E.A. HERRE (2003): Cryptic species of fig-pollinating wasps: Implications for the evolution of the fig-wasp mutualism, sex allocation, and precision of adaptation. — *Proceedings of the National Academy of Sciences of the United States of America* **100**: 5867-5872.
- RAMIREZ W.B. (1970): Host specificity of fig wasps (Agaonidae). — *Evolution N.Y.* **24**: 680-691.
- RAMIREZ W.B. (1974): Coevolution of *Ficus* and Agaonidae. — *Annals of the Missouri Botanical Garden* **61**: 770-80.
- SABETI H. (1994): *Forests, trees and shrubs of Iran*. — Yazd University Publication, 810 pp.
- STOJANOVA H. & H. GHAHARI (2009): Checklists of Iranian Eurytomidae and Torymidae (Hymenoptera, Chalcidoidea). — *Linzer biologische Beiträge* **41** (1): 845-862.
- VAN NOORT S. (2004): Fig wasp (Hymenoptera: Chalcidoidea: Agaonidae, Pteromalidae, Eurytomidae and Ormyridae) and *Ficus* (Moraceae) species richness and biogeography of Monts Doudou in southwestern Gabon. — *California Academy of Sciences Memoir* **28**: 217-233.
- VAN NOORT S. & A. VAN HARTEN (2006): The species richness of fig wasps (Hymenoptera: Chalcidoidea: Agaonidae, Pteromalidae) in Yemen. — *Fauna of Arabia* **22**: 449-472.
- VAN NOORT S. & J.Y. RASPLUS (2010): Order Hymenoptera, Chalcidoidea associated with figs (families Agaonidae & Pteromalidae). — In: van HARTEN A. (ed.), *Arthropod fauna of UAE* **3**: 325-355.
- WEST S.A. & E.A. HERRE (1994): The ecology of the New World fig-parasitizing wasps *Idarnes* and implication for the evolution of the fig-pollinator mutualism. — *Proceedings Royal Society London B* **258**: 67-72.
- WEST S.A., HERRE E.A., WINDSOR D.M. & P.R.S. GREEN (1996): The ecology and evolution of the New World non-pollinating fig wasp communities. — *J. Biogeog.* **23**: 447-458.
- WIEBES J.T. (1979): Coevolution of figs and their insect pollinators. — *Annual Review of Ecology and Systematics* **10**: 1-12.
- WIEBES J.T. & S.G. COMPTON (1990): Agaonidae (Hymenoptera Chalcidoidea, and *Ficus* (Moraceae): fig wasps and their figs, VI (Africa concluded). — *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen (C)* **93**: 203-222.

- WIEBES J.T. (1979): Co-evolution of figs and their insect pollinators. — *Annual Review of Ecology Systematic* **10**: 1-12.
- WEIBLEN G.D. (2002): How to be a fig wasp. — *Annual Review of Entomology* **47**: 299-330.
- ZHANG D.-Y., LIN K. & I. HANSKI (2004): Coexistence of cryptic species. — *Ecology Letters* **7**: 165-169.

Author's addresses:

Hassan GHAHARI
Department of Agriculture
Shahre Rey Branch, Islamic Azad University
Tehran, Iran
E-mail: hghahari@yahoo.com

Simon VAN NOORT
Natural History Department, South African Museum, Iziko Museums
of Cape Town, P.O. Box 61, Cape Town, 8000, South Africa
Zoology Department, University of Cape Town, Rondebosch, 7700,
Cape Town, South Africa
E-mail: svannoort@iziko.org.za